

WHAT IS CLAIMED:

1. An isolated nucleic acid comprising a sequence encoding a human tsp50 protein or an immunogenic fragment thereof.
2. The nucleic acid of claim 1 which encodes the amino acid sequence comprising SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385.
3. The nucleic acid of claim 1 which comprises SEQ ID NO:15
4. A recombinant DNA comprising the nucleic acid of any one of claims 1 to 3 operably linked to regulatory control nucleic acid sequences which can effect expression of said nucleic acid sequence in a host cell.
5. An expression vector comprising the recombinant DNA of claim 4.
6. A host cell comprising the expression vector of claim 5.
7. The host cell of claim 6 wherein said host cell is a eukaryotic or prokaryotic cell.
8. A process for producing a recombinant protein comprising tsp50 or an immunogenic fragment thereof, which comprises:
  - a) culturing the host cell of claim 6 in a culture medium under conditions suitable for expression of said protein in said host cell, and
  - b) recovering said protein from said host cell or said culture medium.
9. The protein prepared by the process of claim 8.

10. A substantially purified tsp50 protein comprising SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385 or an immunogenic fragment thereof.

11. An isolated nucleic acid which is capable of hybridizing to a nucleic acid segment of a TSP50 gene under stringent conditions, said nucleic acid comprising a sequence of adjacent nucleotides of SEQ ID NO:14, said sequence being at least 12 nucleotides long.

12. The isolated nucleic acid of claim 11 wherein said isolated nucleic acid is at least 15 nucleotides long.

13. The isolated nucleic acid of claim 11 wherein said isolated nucleic acid is at least 20 nucleotides long.

14. The isolated nucleic acid of claim 11 wherein said isolated nucleic acid is at least 100 nucleotides long.

15. An isolated nucleic acid comprising SEQ ID NO:13 from about nucleotide number 1 to about nucleotide number 682.

16. An isolated nucleic acid comprising SEQ ID NO:14 from about nucleotide number 1 to about nucleotide number 1240.

17. An antibody which binds selectively to tsp50 protein wherein said tsp50 protein comprises SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385.

18. The antibody of claim 17 wherein said antibody is a monoclonal antibody or a polyclonal antibody.

19. The antibody of claim 17 wherein said antibody is from a mouse or a rat.
20. The antibody of claim 17 wherein said antibody is a human antibody, a humanized antibody or a chimeric antibody.
21. The antibody of claim 17 wherein said antibody is an antigen binding antibody fragment, an Fab fragment, an F(ab')<sub>2</sub> fragment, and Fv fragment or a single chain Fv.
22. The antibody of claim 17 wherein said antibody is obtained from a bacteriophage library.
23. The antibody of claim 20 wherein said human antibody is obtained from a transgenic non-human animal capable of expressing human Ig genes.
24. The antibody of claim 20 wherein said human antibody is obtained from a bacteriophage library.
25. The antibody of claim 20 wherein said humanized antibody comprises one or more complementarity determining regions of non-human origin.
26. The antibody of claim 25 wherein said humanized antibody further comprises surface residues of a human antibody.
27. The antibody of claim 25 wherein said humanized antibody further comprises framework regions of a human antibody.
28. The monoclonal antibody of claim 18 which has been mutated and selected for increased affinity and/or specificity for tsp50.

29. The antibody of claim 20 wherein said chimeric antibody comprises variable domains of a non-human antibody and constant domains of a human antibody.

30. The antibody of claim 17 wherein said antibody has an antitumor agent or a detectable label attached thereto.

31. A pharmaceutical composition comprising an antibody according to any one of claims 17 to 30 and a pharmaceutically-acceptable carrier.

32. A method of producing antibodies which bind to tsp50 protein, wherein said tsp50 protein comprises SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385, which comprises:

- a) immunizing an animal with a suitable amount of tsp50 protein or a polypeptide fragment thereof;
- b) collecting the serum from the animal; and
- c) isolating the tsp50-specific immunoglobulins from the serum of said animal.

33. The method of claim 32 wherein said animal is a mouse.

34. The method of claim 32 wherein said animal is a transgenic animal capable of producing human Ig.

35. A method of producing a hybridoma which secretes an antibody that binds to tsp50 protein wherein said tsp50 protein comprises SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385, which comprises:

- a) immunizing an animal with tsp50 protein or a polypeptide fragment thereof;
- b) obtaining lymphoid cells from the immunized animal;

- c) fusing the lymphoid cells with an immortalizing cell to produce hybrid cells; and
- d) selecting hybrid cells which produce antibody that specifically binds to tsp50 protein.

36. The method of claim 35, wherein said animal is a mouse.

37. The method of claim 35, wherein said animal is a transgenic animal capable of producing human Ig.

38. A method of producing an antibody that binds to tsp50 protein wherein said tsp50 protein comprises SEQ ID NO:16 from about amino acid residue number 1 to about amino acid residue number 385, which comprises:

- a) synthesizing a library of antibodies on phage;
- b) panning the library against a sample by bringing the phage into contact with a composition comprising tsp50 or a polypeptide fragment thereof;
- c) isolating phage which bind tsp50; and
- d) obtaining an antibody from the phage.

39. The method of claim 38, wherein said library is prepared by:

- a) extracting cells which are responsible for production of antibodies from a host animal;
- b) isolating RNA from the cells of (a);
- c) reverse transcribing mRNA to produce cDNA;
- d) amplifying the cDNA using a primer; and
- e) inserting the cDNA of (d) into a phage display vector such that antibodies are expressed on the phage.

40. The method of claim 39 wherein the host animal is immunized with tsp50 protein or an polypeptide fragment thereof to induce an immune response prior to extracting the cells which are responsible for production of antibodies.

41. A method for identifying tsp50 protein in a test sample, which comprises contacting the test sample with an anti-tsp50 antibody or fragment thereof that specifically binds to tsp50 protein under conditions such that tsp50 protein binds to said antibody or fragment thereof and forms a complex therewith.

42. The method of claim 41 wherein said test sample comprises breast tissue or ovarian tissue or testicular tissue or a body fluid.

43. The method of claim 41 wherein said test sample comprises cancer cells.

44. The method of claim 41 which further comprises contacting a control sample with said anti-tsp50 antibody or fragment thereof wherein said control sample has substantially no tsp50 protein.

45. A method for identifying tsp50 protein in a test sample, which comprises

- a) contacting the test sample with a first anti-tsp50 antibody under conditions such that tsp50 protein binds to said first antibody and forms a first complex therewith;
- b) contacting the first complex formed in step (a) with a second antibody that specifically binds to tsp50 protein so as to form a second complex which includes said first antibody, the tsp50 protein, and said second antibody;
- c) contacting the second complex formed in step (b) with an indicator reagent comprising a reporter molecule wherein said indicator reagent is capable of binding to said second anti-tsp50 antibody; and
- d) detecting said reported molecule.

46. The method of claim 45 wherein said test sample comprises breast tissue or ovarian tissue or testicular tissue or a body fluid.

47. The method of claim 45 wherein said test sample comprises cancer cells.

48. The method of claim 45 which further comprises observing whether said first antibody and said second antibody bind to a control sample having substantially no tsp50 protein.

49. A kit for the specific assay of tsp50 protein in a test sample comprising an antibody or antibody fragment capable of binding specifically to tsp50 protein.

50. A method for detecting whether a genomic DNA is hypomethylated or hypermethylated in the region which comprises TSP50 that is present in a test sample of cells which comprises:

- a) cleaving said genomic DNA isolated from said test sample of cells with a restriction enzyme to generate a cleaved test-cell DNA;
- b) hybridizing a probe to said cleaved test-cell DNA to form a hybridization complex, wherein said probe comprises a nucleic acid which hybridizes to said region which comprises TSP50; and
- c) determining the size of the hybridization complex;

wherein said restriction enzyme cleaves a nonmethylated DNA but does not cleave a methylated DNA.

51. The method of claim 50 wherein said test sample comprises breast tissue or ovarian tissue, or testicular tissue or a body fluid.

52. The method of claim 50 wherein said test sample comprises cancer cells.

53. The method of claim 50 wherein said region of genomic DNA which comprises TSP50 is within 10 kb of transcribed TSP50 nucleotides.

54. The method of claim 50 wherein said region of genomic DNA which comprises TSP50 is within 2 kb of transcribed TSP50 nucleotides.

55. The method of claim 50 wherein said restriction enzyme is *Msp* I.

56. The method of claim 50 which further comprises:

- a) cleaving genomic DNA isolated from a control sample of cells with said restriction enzyme to generate a cleaved control-cell DNA,
- b) hybridizing said probe to said cleaved control-cell DNA to form a control-hybridization complex; and
- c) determining the size of the control-hybridization complex.

57. A kit for identifying whether a genomic DNA in a test sample is hypomethylated or hypermethylated in the region which comprises TSP50, said kit comprising a nucleic acid hybridization assay probe capable of forming a detectable hybrid with TSP50 DNA under stringent hybridization conditions.

58. The kit of claim 57 wherein said test sample comprises breast tissue or ovarian tissue, or testicular tissue or a body fluid.

59. The kit of claim 57 wherein said test sample comprises cancer cells.

60. A method of identifying human TSP50 mRNA in a test sample, which comprises:

- a) contacting test sample RNA with a nucleic acid probe comprising a nucleotide sequence which is complementary to a portion of a human TSP50 mRNA; and



b) determining whether said probe hybridizes to said TSP50 mRNA.

61. The method of claim 60 wherein said test sample comprises breast tissue or ovarian tissue or testicular tissue or a body fluid.

62. The method of claim 60 wherein said test sample comprises cancer cells.

63. The method of claim 60 which further comprises identifying TSP50 mRNA in a control sample, said control sample comprising a mammalian tissue sample in which TSP50 is not expressed.

64. A kit for identifying TSP50 mRNA in a test sample, said kit comprising a nucleic acid hybridization assay probe capable of forming a detectable hybrid with TSP50 mRNA under stringent hybridization conditions.

65. The kit of claim 64 wherein said test sample comprises breast tissue or ovarian tissue or testicular tissue or a body fluid.

66. The kit of claim 64 wherein said test sample comprises cancer cells.

67. A method of identifying TSP50 mRNA in a test sample, said method comprising the steps of making a cDNA to said TSP50 mRNA and identifying said cDNA.

68. The method of claim 67 wherein said test sample comprises breast tissue or ovarian tissue or testicular tissue or a body fluid.

69. The method of claim 67 wherein said test sample comprises cancer cells.

70. The method of claim 67 which further comprises identifying TSP50 mRNA in a control sample, said control sample comprising a tissue sample in which TSP50 is not expressed.

71. The method of claim 67 wherein said cDNA is made by reverse transcription.

72. A kit for identifying TSP50 mRNA comprising an oligonucleotide capable of hybridizing to TSP50 mRNA from a test sample and priming reverse transcription of cDNA.

73. The method of claim 67 wherein said cDNA is made by polymerase chain reaction.

74. The method of claim 73 wherein said polymerase chain reaction employs a first primer comprising SEQ ID NO:12 and a second primer comprising SEQ ID NO:11.

75. A kit for identifying TSP50 mRNA comprising primers capable of amplifying a portion of cDNA synthesized by reverse transcription of TSP50 mRNA from a test sample.

76. A method for identifying testicular tissue in a test sample which comprises detecting whether TSP50 mRNA is present in said test sample.

77. A method for identifying testicular tissue in a test sample which comprises detecting whether tsp50 protein is present in said test sample.